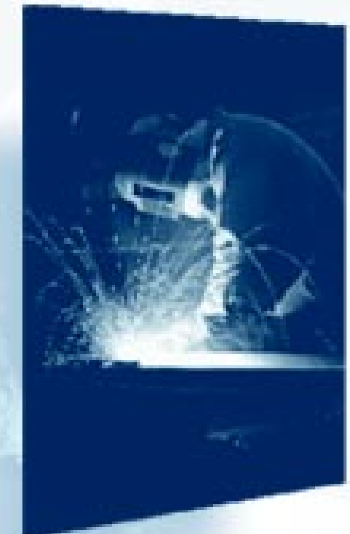

Affordable Readiness and Modernization

1998 Annual Report

NCEMT

National Center for Excellence in Metalworking Technology

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Letters

The U.S. Navy Manufacturing Technology (MANTECH) Program is committed to the development of world-class manufacturing solutions, in the form of advanced materials and processes, for the production of defense weapons systems. These goals are achieved, in part, through the expertise and resources of the National Center for Excellence in Metalworking Technology (NCEMT), one of nine Centers of Excellence sponsored by the MANTECH Program.

The NCEMT, as the focal point for advanced metalworking solutions, represents a key link in the acquisition, evaluation, development, and transfer of leading-edge metalworking technologies for the defense industrial base.

Through these activities, the NCEMT furthers the MANTECH Program's objective to maintain the readiness of U.S. warfighters through cost effectiveness, flexibility, availability, and optimum performance.

Sincerely,

Steven M. Linder
Director, Navy Industrial Programs
Office of Naval Research
Manufacturing Science and Technology

Readiness often boils down to a single moment in time. At that critical moment, are the warfighters and their equipment ready or not? Ships and submarines must be seaworthy, aircraft must be flight ready, and ordnance must be lethal and on target. When no second chances are available, it is essential that equipment be in top working order at a moment's notice.

It is the ongoing commitment of the NCEMT to support the Navy and other services in their readiness goals. For more than 10 years, the NCEMT has provided advanced processes and materials that ensure the reliability and performance needed at the critical moment.

Maintaining readiness often incurs great expense, including sustainment costs, updating equipment and capabilities, and adopting new, more effective weapons systems. To reduce some of these expenses, the NCEMT develops manufacturing techniques that result in significant savings through both reduced acquisition costs and overall life-cycle costs. Notice that many of the projects showcased in this year's annual report serve the dual purpose of increasing component reliability and reducing costs.

Many of these cost and performance improvements are the result of the NCEMT's successful use of Integrated Project Teams (IPTs). The NCEMT carefully selects IPT members from a broad array of industrial, academic, and military organizations, thereby assembling the specific expertise and resources needed for each project. This approach leads to the very best solution at the very least cost and reduces the waste of materials and energy.

As always, I welcome your questions and comments and would be pleased to provide more information about the NCEMT and the metalworking solutions we can offer your organization. Remember, every project is infused with leading-edge capabilities, world-class expertise, and a genuine commitment to excellence.

Sincerely,

Richard J. Henry
NCEMT Program Manager

State of the NCEMT

The NCEMT, established by the MANTECH Program in 1988, has become a pre-eminent resource for state-of-the-art metalworking solutions to manufacturing problems for the defense industrial base. Over the past decade, the NCEMT has consistently developed and transferred advanced materials and manufacturing processes that greatly improve performance and reliability, while significantly reducing costs of specific Navy and Department of Defense (DOD) weapons systems components.

The NCEMT is able to provide the technologies that keep U.S. warfighters ready at a moment's notice through state-of-the-art capabilities. For example, through the application of materials characterization, the NCEMT established optimum process parameters for cost-effective centrifugal casting of titanium carbide (TiC)/bronze components. Specifically, by assessing and documenting the microstructural changes that take place in TiC/bronze during manufacturing, engineers were able to tailor properties for anti-slack devices and hydraulic winch components used in Underway Replenishment operations. The resulting robust manufacturing process provides drums with significantly improved wear resistance that consistently withstand challenging operational conditions.

Another leading-edge capability employed by the NCEMT is process simulation and modeling. This advanced analytical technique is being enhanced and applied to optimize the plasma arc cold-hearth melting (PAM) process by controlling the characteristics of the plasma torch, the refining hearth, and the solidification of the ingot. This optimization will lead to higher material cleanliness and, therefore, greater reliability and longer service life of titanium alloy components for Navy/DOD applications such as F404 engines for Navy F/A-18C/D aircraft and F414 engines for Navy F/A-18E/F aircraft.

The successful use of the NCEMT semi-solid metalworking (SSM) demonstration facility in past projects, and in support of the domestic industrial base, has led to the adaptation of the work cell to handle higher-temperature, more reactive alloys such as titanium. The enhanced facility could be used to optimize the manufacturing process of a wide variety of weapons systems components, including titanium valves and fittings for Navy piping systems. All-up titanium fluid handling systems, being considered for the LPD 17-class Amphibious Transport Ship, significantly reduce the cost of maintenance, repair, and replacement of sea water and sewage systems of Navy ships.

The NCEMT also satisfies modern industrial needs for greater reliability, affordability, and flexibility through the application of Rational Product & Process Design® (R·P^{2}D®). For example, the NCEMT is applying this approach to maximize the performance of candidate commercial steels. The leading-edge, problem-solving tools used in this methodology enforce a focus on quality throughout the design, production, performance, and recycle phases of a steel component. This approach will ultimately lead to significant life-cycle cost reductions, optimized steel production and fabrication procedures, and more durable components with reduced sustainment requirements.

The results of all NCEMT projects are transferred to the Navy and the defense industrial base using leading-edge educational and training techniques, such as engineering knowledge bases (EKB), available through the World Wide Web. These technology transfer and implementation efforts help fulfill the Navy and DOD need for readily available, effective, reliable, and affordable weapons systems.

Affordable Reliability and Advanced Processes

Some of the many facets of readiness include modernization—weapons must be effective on the battlefield; reliability—systems must work the way they are supposed to and when they are supposed to; and availability—components must be easily accessible at a moment's notice, both in cost and supply.

The NCEMT is successfully supplying the Navy and DOD with solutions to meet these readiness needs. For example, at the request of the Naval Sea Systems Command (NAVSEA), the NCEMT is developing enhanced processing for higher-strength steel castings and forgings. These efforts will lead to elimination of costly rework and possible in-service failures due to hydrogen-assisted cracking in higher-strength steel castings and lead to elimination of preheat of higher-strength steel castings and forgings during welding. Approximately 250 tons of HY-80/100 castings and forgings are used on each aircraft carrier (CVN) and submarine (SSN). Thus, the resulting more reliable and cost-effective components will significantly reduce ship fabrication costs.

To eliminate the preheat requirements, the NCEMT is investigating alternative casting and forging alloy compositions. An alloy composition that is more resistant to variations in heat treatment will also allow certification of new sources for large steel castings for Naval applications.

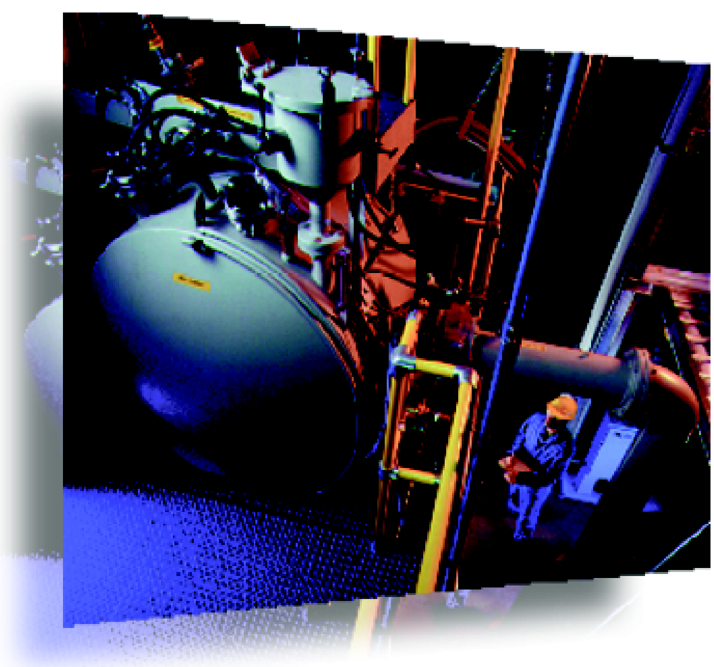
Enabling the use of commercial grades, instead of relying on military specification (mil-spec) grades, will lead to an increase in the availability of materials. Toward this end, the NCEMT is focusing significant efforts toward optimizing commercial steels that meet a required level of toughness without reducing strength or ease of fabrication.

For example, for Naval surface ships such as the LPD 17-class Amphibious Transport Ship, the NCEMT is developing cost-

effective steel production and fabrication procedures to maximize commercial steel performance. The resulting technology will provide the best product for the best price.

Similarly, the NCEMT is optimizing the welding procedures of commercially available consumables to provide reliable performance of HSLA-65 welded joints for ship construction. The use of HSLA-65 steel will enable cost avoidance and improved performance through reduced section thickness and increased design stress levels. Defining optimum joining process procedures will enable the use of HSLA-65 for surface combatant primary hull and secondary structural applications that meet joint strength and toughness requirements, while maximizing the cost savings associated with HSLA-65.

The NCEMT is also developing advanced technologies to manufacture components capable of performing reliably even in the most demanding environments. For example, a melt-related defect could cause an in-service titanium disk failure, leading to the catastrophic loss of an aircraft. To reduce the likelihood of such an event, the NCEMT is working to improve the quality of aerospace materials produced by the plasma arc cold-hearth melting (PAM) process. This will ensure consistently defect-free titanium alloys for military aircraft engines such as the F404/F414 engines of the Navy F/A-18 aircraft.



The NCEMT is also working to develop reliable, lower-cost, thin-walled, nickel-based castings. Successful implementation will fulfill the Navy need for a lower-cost alternative for fabricated titanium diffuser/combustor casings in the T406 engine used on the V-22 Osprey.

These are but a few of the many programs underway at the NCEMT that are reducing the costs of readiness through dependable components, available materials, and advanced, more effective processes.

Demonstration Facilities

Demonstration facilities operated by the NCEMT include sheet metal forming, wire drawing, forging, semi-solid metalworking (SSM), powder metal compaction, powder injection molding, and welding. These facilitate the application of manufacturing solutions to the Navy and defense industrial base by serving as a link between computer simulation and the production floor.

Integrated Project Teams

To make the best, most reliable, and most affordable components possible, the NCEMT assigns Integrated Project Teams (IPTs) to each individual project. Representing Naval and DOD laboratories, centers, and aviation depots, as well as industry and academia throughout the United States, each team member is carefully selected from a broad range of potential partners to address a specific technology challenge.

Working in IPTs results in many benefits, including facilitating the dissemination of enabling technologies for multiple applications and avoiding potential obstacles that can interfere with the implementation of the project results.

For example, an NCEMT IPT that includes members from the Naval Surface Warfare Center (NSWC) at Indian Head, the Program Office for Naval Surface Fire Support, and industry, such as Dynamic Machine Works, has been assembled to optimize the manufacturing process for flow-formed steel casings. This IPT is working to develop a process to produce affordable and reliable 5-inch cartridge casings. The inherently flexible nature of the flow-forming process will enable the technology to be transferred to industry for various other Naval and commercial applications.

The NCEMT created another IPT to optimize the centrifugal casting process for the cost-effective production of consistent quality TiC/bronze drums for anti-slack devices and winches. The team consists of the NSWC's Carderock and Port Hueneme Divisions, Wisconsin Centrifugal Castings, the manufacturer of the drums, and the NCEMT. The resulting optimized process will lead to improved wear-resistant winch drums, thereby reducing maintenance costs and improving personnel safety because of the well-controlled, ship-to-ship transfer of goods. This technology can also be applied to other Naval applications requiring outstanding wear resistance.

Another NCEMT IPT successfully developed the technology to reduce the cost of magnesium atomization technology. Teaming with the U.S. Army Picatinny Arsenal and Hart Metals, Inc., the sole domestic manufacturer of atomized magnesium powder, the NCEMT developed an improved atomization nozzle capable of increasing powder yields from 24 to 31 percent. The nozzle, currently implemented at Hart Metals, will save the Navy $1–2M per year, as well as enable the cost-effective production of atomized magnesium powder for commercial purposes.

An IPT consisting of Rolls-Royce Allison, Ladish, Special Metals, the T406 Program Office, the Naval Air Systems Command Materials Department, and the NCEMT is working to enhance the powder metallurgy processing of superalloys for aircraft engine components. This advanced processing enables the cost-effective production of superior quality weapons systems components and significantly reduces acquisition and maintenance costs over the life cycle of components for the T406 engine.

The NCEMT practice of working in IPTs ensures effective use of funds, adherence to time constraints, and the availability of the necessary resources and expertise—all of which contribute to the lowest possible cost of development and implementation of manufacturing solutions.

Ships

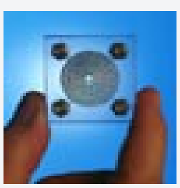
The Navy is maximizing the use of commercial specification steels in surface ships to meet current DOD requirements and to reduce acquisition and life-cycle costs; however, steels produced to current commercial specifications may not perform adequately in critical applications when subjected to military-unique loads. To address this problem, the NCEMT is focusing efforts on optimizing commercial steels to meet the required level of toughness without reducing strength or ease of fabrication.

For example, in a collaborative effort with the Navy, commercial shipyards, and domestic steel producers, the NCEMT is maximizing the performance of candidate commercial steels through cost-effective optimization of current steel production and fabrication procedures. The optimized procedures will lead to Navy use of the best steel for the best price. Implementation on the LPD 17-class Amphibious Transport Ships, the remaining DDG51 AEGIS Destroyers, and the future SC21 (DD21) and CVX ship series is expected to result in an acquisition cost avoidance of more than $34M.

The NCEMT is also ensuring optimum performance while reducing Naval ship fabrication costs by eliminating rework and possible in-service failures due to hydrogen-assisted cracking (HAC) in higher-strength steel castings, and by eliminating preheat of these castings and forgings during welding. This effort, performed in collaboration with the Naval Sea Systems Command (NAVSEA), will significantly improve the reliability of an estimated 250 tons of higher-strength steel (specifically HY-80/100) castings and forgings used on each aircraft carrier (CVN) and submarine (SSN). Eliminating component preheating prior to welding is expected to save an estimated $1.65M annually.

The NCEMT is working with NAVSEA to optimize welding procedures for commercially available consumables to provide reliable performance of HSLA-65 welded joints in Naval ship structures. The use of HSLA-65 will enable acquisition and

Advanced Lightweight Influence Sweep System

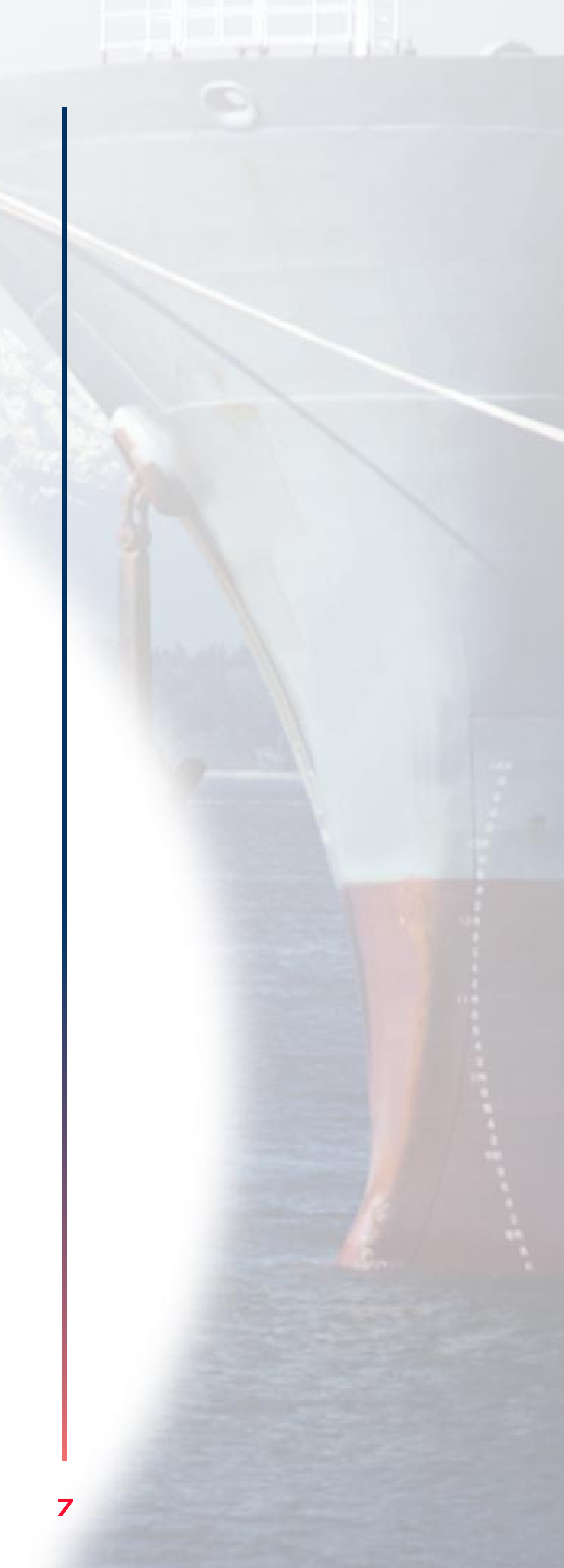


The in-stride mine sweeping system, the Advanced Lightweight Influence Sweep System (ALISS), uses far-reaching magnetic fields to accomplish its mission; however, to meet the required performance, the magnet system is excessively heavy. The Annapolis Detachment of the Carderock Division, Naval Surface Warfare Center, has established that low-temperature, aluminum-stabilized superconducting wires meet performance requirements and offer a 40 to 50 percent weight reduction. The NCEMT is optimizing the manufacturing technology for these superconductors to enable their use. More information on this technology is available via the NCEMT's website, www.ncemt.ctc.com.

life-cycle cost reductions and improved performance through reduced plate thickness and increased design stress levels, as well as improved weldability and weld quality. Employing existing qualified welding procedures and welding consumables traditionally used to join higher-strength steel (51 ksi minimum yield) will prevent an increase in fabrication costs. An estimated cost savings of $25M per ship is anticipated for SC21 (DD21) surface combatants by replacing higher-strength steel with HSLA-65 steel.

In another effort that will improve operational costs of Navy ships, the NCEMT, in conjunction with Naval Surface Warfare Center (NSWC) Carderock, NSWC Port Hueneme, and industry, is establishing optimum parameters for centrifugally casting TiC/bronze drums for hauling winches and anti-slack devices. The resulting robust and repeatable technology will significantly improve the wear resistance of the drums, even under the most rigorous conditions. Implementation of Underway Replenishment (UNREP) ships will save an estimated $25M annually. This technology is also applicable to a variety of components, including torpedo shells, bearings, pistons, liners, and other sliding parts used by all of the services.

Significant life-cycle cost reduction is also expected from using titanium alloys to manufacture valves and piping systems for Naval ships. Titanium alloys show superior resistance to erosion and corrosion, but conventional manufacturing processes are prohibitively expensive. In response, the NCEMT has defined the requirements to apply semi-solid metalworking (SSM) techniques to titanium-based fluid handling components. Implementation of SSM technology would enable both high quality and low manufacturing costs. Applying this advanced process would not only improve day-to-day component reliability, but would also significantly reduce the costs of maintenance, repair, and replacement of sea water and sewage systems of Navy ships.



SUBMARINES

Submarines

To meet future Navy requirements for reliability and affordability, higher-strength steels must be used, thus enabling reduced section thickness. Although steel companies have demonstrated the ability to produce these steels, cost-effective fabrication procedures are critically needed.

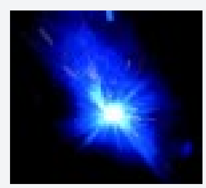
In response, the NCEMT, building on past successes in certifying the use of undermatched weldments for the New Attack Sub (NSSN) pressure hulls, is developing the technology to expand the use of undermatched welding for the manufacture of nonpressure hull structures and components. This advanced technology enables shipbuilders to replace restrictive, costly, higher-yield-strength (overmatching) weld consumables with lower-cost, undermatching consumables. Implementation of undermatching technology will greatly expand the availability of welding consumables and improve affordability by eliminating heat treating. A savings of $3M per NSSN is expected.

The NCEMT, in conjunction with the Naval Sea Systems Command (NAVSEA), is also working to increase availability and reliability of higher-strength steel castings and forgings. Efforts will lead to elimination of costly rework and possible in-service failures due to hydrogen-assisted cracking (HAC) in higher-strength steel castings and eliminating preheat of these castings and forgings during welding.

To eliminate the preheat requirements during welding, the NCEMT will investigate alternative casting and forging alloy compositions. Eliminating component preheating prior to welding is expected to result in an estimated $1.65M annual savings. An alloy composition that is more resistant to variations in heat treatment will also allow certification of new sources for large steel castings for Naval applications. The resulting increase in competition is expected to result in an acquisition cost savings of approximately five percent.

Because of prior success in optimizing higher-strength steel fabrication procedures, the NCEMT has been tasked to develop improved processing techniques for heavy-gage HY-100 and HSLA-100 steel plates. These steels are used in critical ship and submarine structures for resistance to shock, blast, and ballistic loads. Improvements in homogeneity and through-thickness properties of heavy-gage steel plates will ensure survivability and performance under extreme service loads. Several thousand tons of HY-100 and HSLA-100 steel will be required for future NSSN and aircraft carrier (CVN) construction.

Advanced Welding Consumables



In another effort to supply Navy ship manufacturers with cost-reducing, advanced processes, the NCEMT, in conjunction with the Navy Working Group on the Development of Advanced High-Strength Steel Filler Materials, has completed shipyard testing to define operational envelope limits for advanced MIL-100S weld wire composition for HY and HSLA steels. The tests, under various extreme operating conditions, demonstrated the consumables are more resistant to hydrogen-assisted cracking and, therefore, capable of reducing or eliminating costly preheat and post-heat requirements. Implementation of this technology is expected to result in a cost avoidance of $13M per aircraft carrier and $5M per submarine.

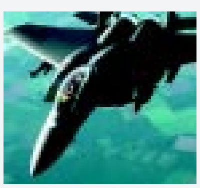
Aircraft

High temperatures and intense loading of jet engines require that engine components meet the strictest standards of quality and reliability. The NCEMT has focused its efforts on ensuring that aircraft components are rugged and dependable through the application of quality aerospace materials and leading-edge manufacturing processes.

For example, the NCEMT, as part of an Integrated Project Team (IPT) consisting of General Electric Aircraft Engines and PCC Airfoils, is developing knowledge-integrated process technology to improve consistency and reliability in the aging process of superalloy turbine airfoils. Building on past successes in knowledge-integrated, solution-treating technologies, this effort focuses on eliminating inconsistencies in the aging process caused by variations in thermal treatments used in brazing, coating, and other processes that occur during manufacturing. These variations lead to inconsistencies in the mechanical properties of the airfoils and, subsequently, to service life. Successful implementation of the improved technology in the F404/F414 engines is expected to significantly enhance reliability and result in a savings of $4.5M.

In another collaborative effort, the NCEMT, the Structural Division of the Naval Air Systems Command (NAVAIR), and Boeing–St. Louis are addressing the root causes of poor reliability in structural castings. This project focuses on replacing fabricated/assembled wrought aluminum structural components with optimized aluminum castings. Vertically integrating component design and casting process design will ensure that optimum structures and mechanical performance are achieved. By raising the reliability of castings to acceptable levels, significant cost and technical advantages can be realized. The technology is expected to result in a savings of $12M for mission-critical components such as the gun bay door on the F/A-18E/F fighter aircraft. Eliminating fabricated structures should also reduce in-service corrosion, leading to reduced sustainment costs.

Aerospace Structural Castings



In an effort to address the root causes of poor reliability in structural castings for Navy aircraft, the NCEMT will develop and demonstrate broad-based casting technologies on a cost-critical aircraft component—the F/A-18 Gun Bay Door. Using a concurrent engineering approach, the NCEMT will integrate state-of-the-art technology tools, such as rapid prototyping, casting simulations, and both destructive and nondestructive evaluations, to provide an effective means of producing reliable castings for large-scale implementation.

The quality of materials used in jet engine components is a major determinant of performance and reliability. To ensure titanium alloys used in the production of engine components are consistently defect free, the NCEMT, in conjunction with GE Aircraft Engines and Allvac, is optimizing the plasma arc cold-hearth melting (PAM) process. Compared to conventional, triple-vacuum arc remelting methods, hearth melting offers a superior ability to remove harmful inclusions and has high potential to improve internal and surface quality of as-cast ingots. Improved reliability and reduced procurement costs of about $1M per year are expected for F404 and F414 engines for the Navy F/A-18 aircraft.

Another effort expected to increase the reliability, effectiveness, and affordability of aircraft engines focuses on thin-wall, superalloy structural casting technology. Specifically, an IPT consisting of Rolls-Royce Allison, PCC Structurals, and the NCEMT is developing an alternative process for manufacturing titanium diffuser/combustor casings for the T406 engine used on the V-22 Osprey. The improved technology will enable the fabrication of reliable, lower-cost, single-piece, thin-walled, nickel-based alloy castings. This new technology will save an estimated $24M in acquisition costs for the T406.

The NCEMT is also reducing costs of the T406 engine through the enhancement of powder metallurgy (P/M) processing. In a team effort with Rolls-Royce Allison, Ladish, and Special Metals, the NCEMT is combining hot isostatic pressing of ultrafine metal powders, extrusion, and isothermal forging with selective sonic inspection to optimize the P/M process and minimize scrap in the production of turbine disks. The forecast savings in life-cycle costs (acquisition and maintenance) is $38M over the duration of the V-22 Osprey program.

Missiles/Ordnance

The application of advanced processes to missiles and ordnance components leads to greater effectiveness in battle and lower acquisition costs.

For example, significant performance and cost improvements are expected from advanced gun systems through the application of the NCEMT's recently completed developments in gun barrel technology. The advancements developed in this project will enable the use of high-impetus propellants in rapid fire cannons. This capability will satisfy advanced gun system performance specifications that demand more ordnance on target at a longer range.

The effort focused on the use of refractory metal alloy liners in medium-caliber gun barrels. Oxide-dispersion-strengthened molybdenum (Mo-ODS) proved to be the most promising material, in that this alloy can withstand the thermal cycles imposed by high-impetus propellants, thus enabling the use of the higher-impetus propellant with long bursts at high rates of fire. In addition to increasing lethality and stand-off distance, the improved barrels also demonstrate improved resistance to erosion and wear, thereby extending the life of the barrels. Implementing this technology can lead to an annual savings of $6.6M.

Another NCEMT project designed to improve performance and extend the life of gun barrels, both advanced performance and conventional, focuses on the development of improved bore coating techniques. Conventional hard chrome plating methods of protecting gun barrels from wear and erosion have become cost prohibitive due to increasingly stringent environmental compliance costs. In response, the NCEMT, as part of the ARDEC Cannon Wear and Erosion Integrated Project Team, has identified several alternative candidate coating/surface treatment processes, including cathodic arc deposition, electrospark deposition, electroless nickel-boron plating, and nickel-tungsten-boron plating. Following extensive evaluation of these techniques, the most suitable technique will be implemented to upgrade small- and medium-caliber weapons for the Navy and

DOD, including the Phalanx, USMC/USAF Vulcan, U.S. Army Bushmaster, and USAF GAU-8 weapons systems.

In response to the Navy need to decrease the costs of atomized magnesium powder, the NCEMT developed an improved atomization nozzle that increases the yield of usable powder during the atomization process. With over 20 flares, tracers, infrared countermeasures, and other pyrotechnic munitions dependent on atomized magnesium in their manufacture, improving powder yield, and therefore, reducing cost per pound, has become critical. The improved nozzle increases powder yield from 24 to 31 percent, leading to an annual savings of $1–2M.

The nozzle was designed using computer-based models to simulate both the fluid dynamics of the atomization gas and the breakup of the molten magnesium stream into powder particles. The new atomization nozzles are currently being implemented at Hart Metals.

In another effort, the NCEMT is working with the Naval Surface Warfare Center at Indian Head to produce an affordable cartridge casing, specifically for the 5-inch gun systems, by optimizing the flow-forming process. This process offers many advantages, including flexibility. With little change in the tooling, cartridge casings of various sizes and calibers can be manufactured. The NCEMT is focusing on the development of optimum process parameters to guarantee that the required tolerances for optimum ballistic performance can be met cost effectively. Successful implementation is expected to save the Navy $2M per year.

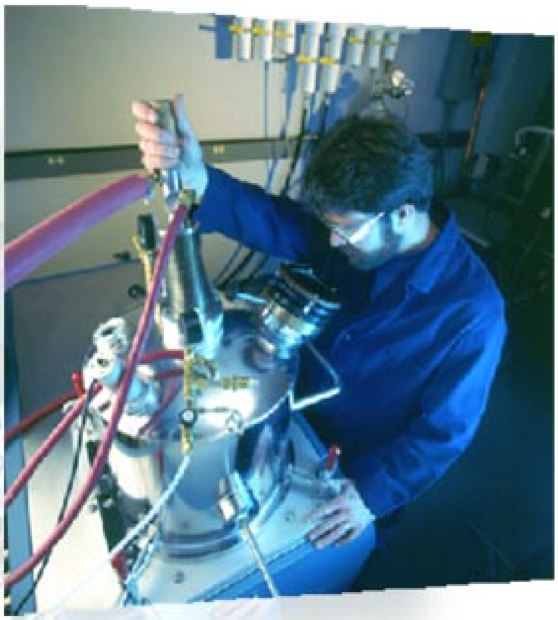
The NCEMT has also improved conventional single crystal manufacturing techniques to fabricate rotor components. This manufacturing process can ensure reliable performance and lower acquisition costs of turbine engines for missiles. The NCEMT's approach involved developing techniques to enable bending of simple, flat-cast bladed platforms into the appropriate curvature for attachment to the rotor disc. The resulting cost-effective process enables increased operating temperature, thereby increasing engine thrust and reducing specific fuel consumption. The enhanced single crystal technology serves to satisfy the readiness needs of the Navy and the other services.

Advanced Gun Barrel Technology

The NCEMT project Advanced Gun Barrel Technology is aimed at improving the performance of medium-caliber, high rate-of-fire gun barrels through coordinated materials/product/process optimization.

Current medium-caliber gun barrels, with chrome-plated or nitrided bore surfaces, are incapable of providing the required 6000-round service life when fired with the new high-impetus propellants.

Leveraging Capabilities



The NCEMT further meets the readiness objectives of the Navy and the other services by adapting many of the technologies developed in-house for wider application within the U.S. defense industrial base. Leveraging existing technology enables proven technologies to be adopted quickly and successfully with fewer obstacles and lower initial development costs.

For example, the significant advances made by the NCEMT in the area of semi-solid metalworking (SSM) are now being adapted to reduce the cost of manufacturing the 25-mm M919 sabot for the U.S. Army. Conventional methods of manufacturing a finished sabot for an ammunition round require many time-consuming, costly machining steps. Currently, the 25-mm M919 sabots are machined from wrought 7075-T6 aluminum barstock at a cost of about $28 per set. Approximately 25,000 sabot sets are produced per month, or 300,000 sets per year. Estimates show that acquisition costs can be reduced by $2.4M per year through the application of SSM techniques to the manufacture of the precision sabot components. Ultimately, the technology will be transferred to industry at large.

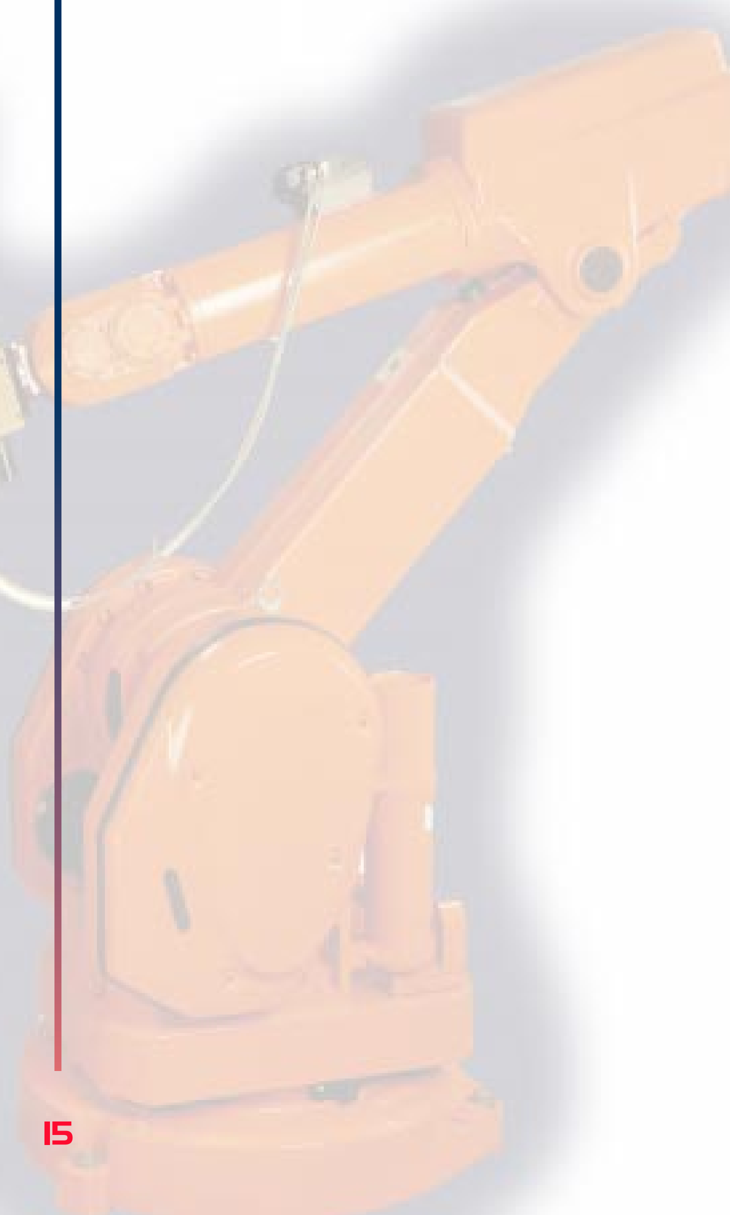
Readiness also depends on information availability. The NCEMT has adapted advanced electronic commerce capabilities to disseminate Navy procurement needs to a wider vendor base. This program, developed at the Federal Industrial Supply Center–Puget Sound, enables more effective generation, exchange, management, and use of digital data to support defense systems and equipment and is expected to result in more efficient, cost-effective transactions with the vendor community.

Ongoing military base closures, such as Cecil Field Naval Air Station and the Orlando Naval Training Center, have necessitated the continued application of retraining programs for displaced Navy employees. The NCEMT has been instrumental in developing and managing a program designed to meet the outplacement needs of these workers. Operated through the

Florida Community College of Jacksonville, it features a sophisticated computerized system that compares an individual's current job skills against existing employment opportunities. Remedial training needs are identified to prepare the individual for outplacement. This system is not only applicable to other defense base closures but to any industrial downsizing.

The U.S. Army Acquisition Pollution Prevention Support Office (AAPPSO) and Corpus Christi Army Depot (CCAD) have accessed the capabilities of the NCEMT to assess the applicability of pulsed optical energy decoating as an alternative process for decoating Navy helicopter rotor blades. The NCEMT demonstrated the capability of pulsed optical energy systems to reduce waste disposal and labor costs in the removal of aircraft coatings, without damaging substrate integrity or causing adverse metallurgical effects.

Coatings used on advanced composite materials for helicopter rotor blades were typically removed by costly, time-consuming mechanical methods such as hand sanding. To overcome the limitations of conventional decoating techniques, the NCEMT optimized and evaluated a state-of-the-art, pulsed CO_2 laser system. Using NCEMT testing facilities, components of the system and helicopter blade stripping integrity were proven acceptable.



Technology Transfer Activities

To promote the transition of advanced technologies to the civil-military industrial base, the NCEMT sponsors a variety of technology transfer activities including workshops, formal courses, and technology demonstrations. Many of these activities, such as users groups, provide members of the Navy, government, and commercial industry with opportunities to learn state-of-the-art techniques and processes in a hands-on, educational atmosphere. Other, more broad-based activities, such as electronic databases and publications, serve to disseminate technical developments to a wide audience. The following are highlights of the 1998 technology transfer events:

Semi-Solid Metalworking: The NCEMT held its sixth Semi-Solid Metalworking (SSM) Users Group Meeting on March 24–25. This year's meeting provided members of commercial, defense, and academic organizations with the opportunity to review SSM projects currently underway at the NCEMT, discuss their SSM needs, concerns, and accomplishments, as well as formulate plans for future activities and projects.

Modern Shipbuilding Technologies: This NCEMT-sponsored information exchange enabled members of the shipbuilding industry, representing both shipyards and Navy Program Offices, to exchange ideas on shipbuilding processes and technologies. The NCEMT presented innovative technologies, materials, and tools that could lead to reduced acquisition and life-cycle costs for Navy and commercial ships. This meeting also provided a forum for discussing activities aimed at transitioning new, but mature, technologies used in other industries to commercial and military shipbuilding. The event, held July 14–15 in Arlington, Virginia, featured William Houley (RADM USN, Ret.), Director of the Defense Reform Initiative, as a keynote speaker.

Single Crystal Fabrication Workshop: On August 19, the NCEMT sponsored an intensive workshop to capitalize on the properties of single crystal products. The attendees reviewed aspects of forming single crystal castings into altered configurations that enable greater cost effectiveness while still maintaining the preferred properties of the original single crystal. The discussions focused on expanding the inherent cost advantages of this process to other applications within the military and U.S. industry.

National Center for Excellence in Metalworking Technology (NCEMT)

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